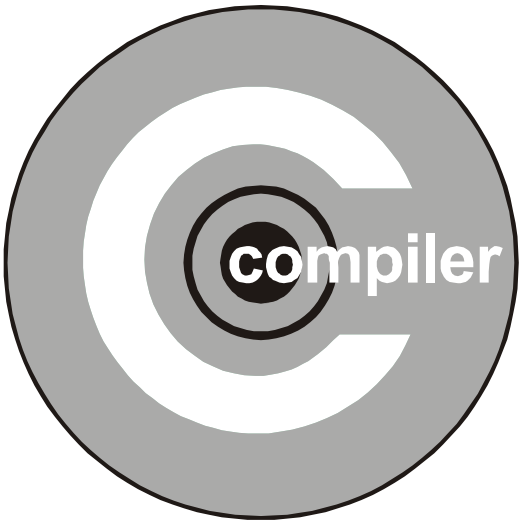
PICC

ANSI C COMPILER



Quick Start Guide

HI-TECH
SOFTWARE

PICC Quick Start Guide

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Introduction

Welcome to HI-TECH PICC for Windows 9x, Windows NT/2000/XP, Linux and UNIX. PICC is more than a C compiler - it is a complete development system for C and assembler. With features like an integrated development environment[1], assembler-free programming, and an intelligent optimizer, you can develop exceptionally tight and fast code with ease.

NOTE: By default, this package runs in a time-limited (21 days) demo mode. After purchasing a license, you will need to register the compiler in order to receive an activation key. Then using the received activation key you can activate the compiler, to take advantage of all the compiler's features and to remove the time-limitation.

Environment

PICC can be run entirely from the HI-TECH Professional Development environment. This environment allows you to manage all of your PIC projects. You can compile, assemble and link your embedded application with a single step.

Features

PICC is an ANSI C compiler, supporting all standard data types including floating point. Features of the compiler include:

- ❒ Unlimited number of source files
- ❒ Multiple optimization levels
- ❒ Comprehensive library with source code
- ❒ Floating point support (24-bit and 32-bit IEEE)
- ❒ Mixed C and assembler programming
- ❒ Optimizing assembler
- ❒ Full linker, with overlaying of local variables to minimize RAM usage

1. The HI-TECH Professional Development environment (HPD) is not available under Linux or UNIX systems.

1.1 What's On the CD-ROM

PICC has everything you need to develop applications for Microchip's extensive range of low-power 12/14/16/17 series PIC microcontrollers. This package includes:

- ❒ The Windows and Linux versions of the PICC Compiler.
- ❒ PICC comprising:
  - HI-TECH Professional Development environment
  - ANSI C Compiler
  - Intelligent optimizer
  - Optimizing assembler
  - Full relocating linker
  - Comprehensive library including floating point and full source
- ❒ PICC manual in:
  - PDF format
  - HTML format
- ❒ This *Quick Start Guide* in PDF format
- ❒ Adobe Acrobat reader
- ❒ Third Party Development Tools, such as:
  - Microchip's MPLAB IDE
  - Phyton Project-MC
  - Salvo RTOS Demo Version
  - TechTools Design Environment (TDE)

1.2 Using This Guide

This guide is an introduction to PICC. It tells you:

- ❒ How to install PICC
- ❒ How to register your copy of PICC
- ❒ How to activate your PICC compiler
- ❒ How to use the on-line manual
- ❒ How to get started with your first program
- ❒ How to get technical support

1.3 System Requirements

PICC runs on any Intel based PC and UNIX machines. For use on a PC, PICC requires:

- ❒ Windows 9x (or later), or Windows NT 3.51 (or later including 2000 and XP), or any version of Linux
- ❒ A personal computer with a Pentium processor (or better)
- ❒ Hard disk with 15Mb of available disk space
- ❒ CD-ROM drive

For use on UNIX machines, PICC requires:

- ❒ Hard disk with 15Mb of available disk space

Compiler Installation

The compiler installation procedure depends on the operating system which you are using, however in all cases the procedure followed is:

- ❒ Optional installation of software downloaded from HI-TECH's web site,
- ❒ Purchase of a license,
- ❒ Receipt of the physical software package via courier along with *serial number* and *registration key*,
- ❒ Registration of your compiler and customer details with HI-TECH Software, after which, we will send you the *activation key*; and
- ❒ Activation of your compiler using the *activation key*.

If you have an internet connection, you may be able to perform the last two steps online.[1]

2.1 Windows Installation

PICC is supplied on a CD-ROM. Insert the CD-ROM into the CD-ROM drive of your computer, then an autorun program will start up. If you have disabled the autorun feature, you may start the program by running `autorun.exe` on the CD-ROM drive.

The window displayed by the autorun program has several buttons. These are described below.

Exit Selecting this button quits the autorun program.

About Selecting this button opens a dialog displaying information regarding the install program.

Web Selecting this button will open your default internet browser to our web site, providing you currently have an internet connection.

1. This will be introduced in later versions of the compilers.

Install compiler This button runs a separate install program which installs the PICC compiler onto your system. The install program will prompt for information as it proceeds. More information on the installer can be found in section 2.1.1 on page 12.

Manual (PDF) Select this button to view the PDF version of the PICC user's guide on the installation CD-ROM.

Manual (HTML) Select this button to view the HTML version of the PICC user's guide on the installation CD-ROM.

If desired, you may go straight to the compiler install program by running `compiler\setup.exe` on the CD-ROM drive.

2.1.1 Compiler Install Program

The install program performs several tasks.

- ❒ It installs onto your system, the full version of the compiler including all applications, header files, libraries, and sample and library source code to the specified distribution directory.
- ❒ It adds to the `PATH` variable the BIN directory of the distribution.
- ❒ It sets the `HTC_PIC` environment variable to be the distribution directory.
- ❒ It also installs the PDF and HTML versions of the user's guide.

The installer does ***NOT*** register the software. Registration can be performed anytime after you receive a *serial number* and *registration key*. These are supplied with the software CD and printed material shipped after you purchase a compiler license. They are located on the inside cover of the printed version of the Quick Start Guide. See section 2.3.2 on page 16 for more information on the security and registration of this compiler.

After the install program is run, you will see several preliminary dialog boxes displayed.

The main install window is entitled "PICC Compiler Setup". From this point, the installation process is relatively standard. Read the instructions presented in the dialog and follow the prompts. It is *required* that the compiler is not installed into a directory whose path contains *space* characters, as this will cause compiler components to read the wrong number of arguments. Read the license agreement shown by the install program as you are bound by this agreement if you use the software.

The install program will inform you if the installation was not successful. If the compiler does not install and you are unable to resolve the problem yourself, contact technical support. Section 3.3.5 on page 21 has contact details.

2.1.2 Installing Additional Applications

The CD-ROM contains a version of the Abode Acrobat (PDF) reader. This program allows you to view the PDF version of the user's guide. If you wish to install it, first quit any web browser running, run the self-extracting archive in the `manual\acrowin` directory of the CD-ROM drive, and follow the instructions on the screen.

The CD-ROM also contains a version of Microchip's MPLAB IDE. This program is not necessary to run the compiler, but it can be used to perform simulation (or emulation if you have the appropriate hardware) of compiled code. If you wish to install this program onto your system, run the self-extracting archive in the `mplab` directory on the CD-ROM. MPLAB documentation is also provided in this directory.

2.1.3 Accessing the Compiler

The command-line compiler driver is `PICC (picc.exe)`. This is normally the only command you need to access the compiler, but you may also want to run other applications, such as the assembler or linker, directly. See the user's manual for more information on the compiler's applications.

2.2 UNIX/Linux Installation

As Linux and specific UNIX systems are similar in their design, the below can be followed for either a Linux OS or a UNIX based system. Note that UNIX versions of the compiler are purchased separately.

To install the compiler, you will first need to create a directory. By default the directory the compiler driver will expect is `/usr/hitech` but this can be overridden by setting the `HTC_PIC` environment variable. Ensure that you have the necessary permissions to create and modify the area of the file system in which you will be installing the compiler, and to access the CD-ROM drive of the computer.

To extract the compiler, first create the directory into which you will install the compiler (replacing the directory name with whatever you have chosen):

```
mkdir /usr/hitech
```

Then change into the CD-ROM directory and copy the directories from here to the installation directory you have made above. The files on the CD-ROM may be mounted at a different point in your file system - use the appropriate path for your system.

```
cd /mnt/cdrom
cp bin /usr/hitech
```

Also copy the `include`, `libc`, `lib` and `help` directories to the same location.

The compiler will now be installed. You should add to your `PATH` environment variable the `bin` directory, for example `/usr/hitech/bin`. If the directory is anything other than `/usr/hitech` then you will need to set the environment variable in your `.cshrc` or `.profile` file. For example, in `.cshrc` (for the c-shell) add the line:

```
setenv HTC_PIC /home/hitech
```

A Bourne shell user will require the following lines in .profile:

```
HTC_PIC=/home/hitech
export HTC_PIC
```

Again replace the directory name with whatever you have chosen.

Run the command

```
picc -setup
```

as a user with write permissions to the distribution directory. The compiler will then operate in demo mode and can be used immediately by an ordinary user. Registration of the compiler will need to be performed to remove the demo mode restrictions. See 2.3.3 on page 17 for more information on activating the compiler.

If you wish to install the acrobat reader, this is located in the directory `acrobat`. Uncompress and extract this package using the following:

```
gzip -d filename.gz
tar xf filename.tar
```

where *`filename`* is the name of the file present in the directory. Run the INSTALL program to install the package onto your system.

2.2.1 Accessing the Compiler

The UNIX/Linux command-line compiler driver is `picc`. This is normally the only command you need to access the compiler, but you may also want to run other applications, such as the assembler or linker, directly. See the user 's manual for more information on the compiler's applications.

The command line options are the same as for MS-DOS - just use the `PICC` command as described later.

2.3 Registration and Security Information

2.3.1 Overview

Both the Windows and Linux version of this compiler have new in-built security features. The registration process is also different from earlier versions of the compiler. A new on-line registration program is currently being developed, however registration of this product can be performed via our web site.

After installation, this version of the compiler will run in *demo mode*. Compilation of programs may take place in demo mode, but the compilation process will be slower and certain command line options will be disabled, in particular:

`-M`	for map file generation
`-D`*`macro`*	to predefine macro symbols
`-PRE`	to preprocess only source modules
`-L`	to specify libraries to be scanned by the linker
`-L-`*`opt`*	to allow specification of additional linker options
`-RESROM`	to reserve ROM locations
`-RESRAM`	to reserve RAM locations
`-V`	for verbose compilation messages

There are no code limitations in demo mode. Since you can download this compiler from HI-TECH Software's web site and use it immediately, albeit in *demo mode*, you do not need to wait for the physical compiler to be shipped before starting on urgent projects.

The compiler will continue to operate in demo mode for 21 days, after which it will expire and cease to function. If you have purchased and registered the software, you may activate it to remove the time-limited operation, even if it has expired.

If you have purchased a version of the PICC compiler prior to version 8.00 and you are updating to this version, you will need to re-register. Either use the registration page on our web site or mailto://register@htsoft.com the regform.txt file located in the distribution directory. You will receive a modified *serial number*, *registration key* and *installation key* to allow you to fully activate this update. Please supply your existing *serial number*, but you can omit the *registration key* since that has not been shipped to you. You have 21 days in which to complete this procedure, however you can still activate the compiler even if it has expired.

If you have purchased this version of the compiler, the *serial number* and *registration key* are supplied on the inside front cover of the Quick Start Guide which is shipped with the physical compiler package.

Once you have your new *serial number* and *registration key* you can register one of several ways.

- ❒ On our web site http://www.htsoft.com. Go to the registration page and submit your details (recommended)
- ❒ mailto://register@htsoft.com the completed `regform.txt` file which is located in the top directory of your distribution
- ❒ Fax to +61 7 3552 7778 either the `regform.pdf` located in the top level of the compiler distribution directory, or the completed registration card
- ❒ You may use the registration card that was shipped with the package and send that to the address on the card

In future, an on-line registration program will be supplied to simplify the registration process.

After registering you will receive an *activation key* via e-mail which will fully activate the compiler and remove the time-limited operation. Keep your *serial number*, *registration key*, *activation key* and the exact *user name* you specified when registering in a safe place for future reference. This way you do not need to contact us again if you need to re-install the compiler.

2.3.2 Activating the Compiler under Windows

To activate your installed PICC compiler, run from the Start Menu the following program, Start | Programs | HI-TECH Software | Compiler Activation. This program will activate your PICC compiler and remove all demo mode limitations.

After the program is run select the compiler type you wish to activate from the list, if more than one selection appears. Proceed to the next window by selecting the **next** button. In this window enter your *serial number*, the serial number prefix has already been inserted. Next enter the owner's first and last name as specified when registering the license, then enter the *activation key*. Select the **activate** button to complete the activation process. A window will tell you whether your activation has succeeded or failed. If the process failed, try again making sure you have not entered spaces after any of the information inserted.

Once activated the demo-mode disclaimer should not be displayed when subsequently running the compiler.

2.3.3 Activating the Compiler under Linux/UNIX

Once you have your *activation key*, you can activate the installed compiler. Activation must be performed by a user with write permissions to the distribution directory. The registration information sent to you, or which you obtained on-line, will have the appropriate command line to execute.

After running the command, the compiler should be activated. The demo-mode disclaimer should not be displayed when subsequently running the compiler.

Getting Information

3.1 Online Help

A limited amount of online help is available via the **H**I-TECH **P**rofessional **D**evelopment (**HPD**) environment or via the command line.

In HPD, help may be accessed via the *Help* menu option. A help button will also appear at various times (e.g. during compilation when an error occurs) which provides context-sensitive help.

The command line compiler will give a list of available options via the *-help* option.

3.2 Online Manuals

The online manual is a comprehensive guide to using the compiler. It is provided on the CD-ROM under the `manual` directory, but is also copied to your distribution directory by the installer. The manual is provided in both Acrobat format (`manual.pdf`) and HTML format (`html\index.htm`). A printed version of the manual can also be purchased, through either HI-TECH Software directly or any of our resellers.

The PDF version of the manual may be viewed using any PDF display program. Acrobat Reader is supplied on the CD-ROM for viewing the manual in this format.

The HTML version of the manual may be viewed using any HTML browser with support for HTML version 1 or greater.

3.3 Technical Support

This section provides details of technical support for product purchased directly from HI-TECH Software. If you did not purchase this product directly from HI-TECH Software, *always contact your supplier first for technical support*. Please make sure when requesting technical support to *always* supply your *serial number.*

3.3.1 Registration and Free Technical Support

In order to receive free technical support, you will need to register your copy of the compiler. This can be done in one of the following ways:

- ❒ On our web site http://www.htsoft.com. Go to the registration page and

submit your details (recommended)

- ❒ mailto://register@htsoft.com the completed `regform.txt` file which is located in the top directory of your distribution
- ❒ Fax to +61 7 3552 7778 either the `regform.pdf` located in the top level of the compiler distribution directory, or the completed registration card
- ❒ You may use the registration card that was shipped with the package and send that to the address on the card

Once you have registered, you are then entitled to 90 days of free technical support, starting from your first contact with us. You are also entitled to one free update, this can be found on our web site or sent out to you on request.

If you change your contact details, please let HI-TECH Software know.

3.3.2 Compiler Update

A compiler update may be purchased at any time to update your compiler to the current version. Please note that when purchasing a compiler update it comes with *no* added technical support and is a one off compiler update only.

3.3.3 Extended Support Option

An Extended Support Option can be purchased at any time and offers the customer the following items:

- ❒ 12 months unlimited technical support
- ❒ The current version of the compiler, for those customers who require it
- ❒ All compiler specific updates released during the extended support period, via our web site

The Extended Support Option may be ordered via our online ordering page on our web site. If you choose not to take out the Extended Support Option, you may still send technical support requests, but considerable delays may be experienced.

3.3.4 Minor Updates

From time to time, minor updates of the compiler will be made available on the HI-TECH Software web and ftp servers:

www http://www.htsoft.com/

ftp	ftp.htsoft.com

These updates may be downloaded free of charge. Please note that updates will not upgrade from one major version to another. Upgrades may be purchased individually as stated above.

3.3.5 Contacting Technical Support

Technical support may be contacted in one of the following ways:

email	support@htsoft.com

Using the on-line support request form on our web site may speed up your request.

fax/voice mail (USA only)	(408) 490 2885
fax	+61 7 3552 7778
phone	+61 7 3552 7782
post	HI-TECH Software Technical Support PO Box 103 Alderley QLD 4051 Australia

3.4 Ordering Parts

The following can be ordered either directly through HI-TECH Software or from your original point of purchase:

- ❒ Additional licences
- ❒ Printed copies of the manual
- ❒ Extended Support Option
- ❒ Additional Media

3.5 HI-TECH Software Resellers Worldwide

This is a list of HI-TECH software resellers worldwide.

AUSTRALIA . . . . **HI-TECH Software**
Phone +61 7 3552 7777
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BRAZIL . . . . . .**Anacom Software e Hardware Ltd**
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Getting Started

For new users of the PICC compiler, the following section provides a step-by-step guide to getting your first program running in a target system. You'll need a working PIC system, and some means of programming the PIC. Of course, you'll need to have installed the compiler as described in the previous chapter.

You will find a complete guide to using HPDPIC and PICC in the chapters *Using HPDPIC* and *Command Line Compiler Driver* in the PICC user's guide.

One thing should be made clear; with embedded programming there really is no such thing as a "quick start". There are several variables, e.g. the hardware, memory, I/O devices and the software, all of which must be exactly right or the program will simply not work. There are no error messages when your embedded program crashes - it is a black box. Be prepared to check everything carefully, and if possible start with known working hardware. Debugging hardware and software at the same time squares the degree of difficulty.

4.1 A Sample Program

```
#include<pic.h>

/*
 *    Demo program - flashes LEDs on
 *    Port B, responds to switch press
 *    on RA1. Usable on PICDEM board.
 */

#define PORTBIT(adr, bit) ((unsigned)(&adr)*8+(bit))

static bit button @ PORTBIT(PORTA, 1);


main(void)
{
      unsigned i;
      unsigned char j;

      TRISB = 0;        /* all bits output */
      j = 0;
      for(;;) {
            PORTB = 0x00;     /* turn all on */
            for(i = 16000 ; --i ;)
```

```
            continue;
        PORTB = ~j;       /* output value of j */
        for(i = 16000 ; --i ;)
            continue;
        if(button == 0)   /* if switch pressed, increment */
            j++;
    }
}
```

The small sample program shown is written for the PIC16C84 processor running on the Microchip PICDEM 1 demo board which has 8 LEDs attached to Port B. It loops forever flashing the LEDs. If your hardware is different, as it almost certainly is, you should write a similar program tailored for your particular hardware. Flashing LEDs is however a good place to start, as it provides a visual indication of program function. If you don't have LEDs attached, then you could monitor an output port line with an oscilloscope or logic probe. Alternatively, you could even monitor address lines with an oscilloscope or logic analyser. The idea is to be able to determine that the program is running correctly using a minimum of resources, so as to remove as many variables as possible from the problem.

Once the first program is running, it is easier to progress from that point than to try and run a complex program from the beginning. To get this program running, you will need to compile it, either using HPDPIC (the integrated development environment) or PICC (the command line compiler driver).

4.2 Using HPDPIC

To enter this program, simply follow these steps:

- ❒ Start HPDPIC; open a Command Prompt (DOS box), then type *hpdpic*, then press *enter*. If you have installed HPDPIC properly, it will be in your search path. You should have on screen a *menu bar*, a large *edit window*, and a smaller *message window*.
- ❒ Start typing the program text in the edit window. The editor command keys allow either the standard PC keys (arrow keys etc.) or WordStar-compatible keystrokes.
- ❒ After typing the complete program (with any modifications necessary for your hardware) save the file by pressing *alt-s*. A dialog box will appear asking you to enter a name to save the file to. Type the name *sample.c* and press *return*. The file will be saved to disk.
- ❒ Press *alt-p* to open the **Options** menu. Use either the mouse or arrow keys to select the item **Select processor...**. This will open a dialog box enabling

you to select the processor you are using. Press *return* to exit the dialog box.

- ❒ Press *alt-p* again and select the **Output file type...** item. This will open a dialog box allowing you to select an output format for your executable file. Choose a file format compatible with your programming process. Bytecraft COD and Intel HEX are the most commonly used formats. Press *return* to exit the dialog box.

- ❒ Press *F3* to compile the program. If you haven't saved the edit file, you will be prompted to do so now. Save it as *sample.c*. HPDPIC will compile the program. Any errors found will stop the compilation, and the errors will be listed in a window that appears at the bottom of the screen. The cursor in the edit window will be positioned on the error line. Correct the error, then press *F3* again. HPD remembers the processor type and output type you selected previously, so you will not have to re-enter this information.

  On completion of compilation, an output file called *sample.cod* (or *sample.hex* for Intel hex) will be left in the current directory.

- ❒ Exit HPDPIC by pressing *alt-q*.

4.3 Using PICC

To use PICC to compile your sample program, you will first need to create a file containing the program. You can use whatever text editor you are familiar with, as long as it can create a plain ASCII file. The MS-DOS *edit* command is satisfactory. Save the file as *sample.c*. To run PICC, type:

```
picc sample.c
```

If you are compiling for the 16C84, for example, you should add the `-16C84` option, e.g.

```
picc -16c84 sample.c
```

This generates code for the 16C84 instruction set.

If you have correctly entered the sample program, no error messages should result. If you do get error messages, edit the program to correct the errors, and recompile with PICC as before. Here is sample output from PICC:

```
C:\HT-PIC\SAMPLES>picc sample.c
HI-TECH C COMPILER (Microchip PIC) V8.00PL2
Copyright (C) 1984-2002 HI-TECH SOFTWARE
Serial no: HCPIC-12345; Licensed to:
```

```
Joe Citizen, HI-TECH Software
Select chip type from one of:
12C508 12C509 14000 16C52 16C54 16C54A 16C55 16C554
16C556 ...
Type: 16c84

Memory Usage Map:

Program ROM   $0000 - $0005  $0006 (     6) words
Program ROM   $03E0 - $03FF  $0020 (    32) words
                             $0026 (    38) words total Program ROM

Bank 0 RAM    $000C - $000D  $0002 (     2) bytes total Bank 0 RAM

Program statistics:
Total ROM used       38 words (3.7%)
Total RAM used        2 bytes (5.6%)
```

Points to note:

- ❒ The processor was not specified, so PICC prompted for the processor.
- ❒ PICC has printed a short summary of memory usage.

4.3.1 Output File Format Selection

The compiler supports various output file formats. The two most commonly used for input into a programmer are Intel HEX and binary. The default output file formats for PICC are both Bytecraft COD and Intel HEX, but can be changed with one of the following options to PICC:

-motorola Produce Motorola S1/S9 HEX file

-bin Produce a binary output file

-ubrof Produce an IAR Ubrof file

-aahex Produce HEX records with symbols for American Automation emulators

-tek Produce Tektronix HEX file output

4.4 Running your program

Once you have compiled the program, you will have a file called *sample.cod* and a file called *sample.hex* in the current directory. How you get this into your hardware will vary depending on just what you have to work with, but generally speaking you will need a programmer to allow you to get the program into the memory of your

target system. The exact procedures for doing so are beyond the scope of this manual.